

NON-PUBLIC?: N  
ACCESSION #: 9201130206  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: CRYSTAL RIVER UNIT 3 (CR-3) PAGE: 1 OF 5

DOCKET NUMBER: 05000302

TITLE: Reduction in Reactor Coolant System Pressure Due to Failure of  
Pressurizer Spray Valve and Associated Position Indication  
Results in Actuation of Reactor Protection System and Engineered  
Safeguards  
EVENT DATE: 12/08/91 LER #: 91-018-00 REPORT DATE: 01/07/92

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 015

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION:  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:  
NAME: W. A. Stephenson, Nuclear Safety TELEPHONE: (904) 795-6486  
Supervisor

COMPONENT FAILURE DESCRIPTION:  
CAUSE: B SYSTEM: AB COMPONENT: AB V MANUFACTURER: W030  
D AB AB V W030  
REPORTABLE NPRDS: Yes  
No

SUPPLEMENTAL REPORT EXPECTED: Yes EXPECTED SUBMISSION DATE:  
07/07/92

ABSTRACT:

On December 8, 1991, Crystal River Unit 3 was being returned to power operation. As reactor power was being increased from 11% RATED THERMAL POWER (RTP) to 15% RTP, Reactor Coolant System (RCS) pressure increased to the open setpoint for the Pressurizer Spray Valve, RCV-14. RCV-14 opened; however, the "closed" indicating lamp did not extinguish. On decreasing RCS pressure, RCV-14 did not close, resulting in a continued slow decrease in RCS pressure. Prior to RCS pressure reaching the Engineered Safeguards (ES) actuation setpoint, an operator inappropriately bypassed ES. Shift supervision directed ES out of bypass

and ES actuation was initiated. After ES was reset, a plan was implemented which bypassed ES and used High Pressure Injection to raise RCS pressure. RCV-14 was manually isolated, terminating the event. The plant was placed in MODE 5 (COLD SHUTDOWN) and RCV-14 was repaired and tested satisfactorily. Plant Maintenance Procedures are being revised to preclude recurrence of this type of Motor Operated Valve failure. Administrative guidance has been developed on the bypassing of ES actuation signals.

END OF ABSTRACT

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#### EVENT DESCRIPTION

On December 8, 1991, Crystal River Unit 3 was being returned to power operation following a reactor trip on December 3 and a short maintenance outage to repair excore Nuclear Instrumentation (NI) IG!. The plant was operating in MODE 1 (POWER OPERATION) at 11% RATED THERMAL POWER (RTP)

and power was being slowly raised. At 0247, power was increased from 11% RTP to approximately 12% RTP. At 0249, power was again increased, this time from approximately 12% RTP to approximately 14% RTP. During each of these power increases, Reactor Coolant System (RCS) AB! pressure increased to the 2205 psig setpoint for opening of the Pressurizer Spray Valve, RCV-14 AB,V!. The "closed" indicating lamp IL! did not extinguish in either instance. RCV-14 AB,V! failed to close, resulting in a steady decrease in RCS AB! pressure over the next 19 minutes. Troubleshooting strategies in the control room during this time period included taking manual control of RCV-14 AB,V! and selecting it to the "closed" position. This was done despite the fact that the spray valve indication never changed from indicating full closure of the valve which had led the operators to believe it had not opened. Control room operators also looked for symptoms of a Loss of Coolant Accident (LOCA) and pressurizer heater failures. The operators concluded that a LOCA was not in progress, however they still suspected that the pressurizer heaters were not functioning normally. They also evaluated the possibility that the continuing RCS AB! depressurization might be the result of a secondary plant induced overcooling of the RCS AB!. This was based on secondary plant anomalies which existed just prior to the onset of the transient. At 0308, RCS pressure decreased to the Reactor Protection System (RPS) JC! low RCS pressure setpoint of 1800 psig, resulting in a reactor trip.

Following the reactor trip, RCS AB! pressure did not recover as expected. By 0311, RCS AB! pressure had decreased below 1700 psig and

the permissive to manually bypass automatic High Pressure Injection (HPI) BQ! actuation had been met. Prior to reaching 1500 psig, one of the control room operators announced and bypassed both trains of HPI BQ! but did not receive permission nor was his announcement acknowledged although operator interviews indicated that the Senior Reactor Operator (SRO) on duty was aware of the bypass. This action, taken at approximately 0313, was inappropriate since the reason for the ongoing RCS depressurization had not yet been diagnosed and management concurrence with the ES bypass had not been obtained. The acting Operations Superintendent, after completing phone notification of the Plant Manager, recognized that the operator had bypassed ES and recommended, to the SRO on duty, removal of the bypass. While this action was being discussed, two of three ES low RCS pressure (1500 psig) bistables tripped and the SRO on duty immediately ordered the bypass removed, at which time full HPI actuation occurred automatically. The Emergency Feedwater Initiation and Control (EFIC) JG! System was also actuated by the HPI signals, resulting in the automatic start of both Emergency Feedwater (EFW) pumps BA,P!. Both pumps were subsequently shutdown when Main Feedwater (MFW) flow was verified to be acceptable.

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Full HPI BQ! flow to the RCS occurred for approximately one minute, after which the system was once again placed in ES bypass, per the procedure, so that equipment could be manually controlled. HPI BQ! flow continued for approximately another minute and was then terminated due to the rapid recovery in RCS pressure. The ES bistables were then reset to arm the HPI System BQ! for reactivation. Following the termination of HPI, RCS pressure again began to decrease due to RCV-14 AB,V! still being open. At approximately 0335, one of the three ES 1500# bistables tripped. As RCS pressure decreased to a minimum value of 1503 psig on the Loop "A" Wide Range indication, considerable discussion by the control room crew led to a plan to bypass ES, since a full actuation was not necessary based on observed indications, and to increase makeup flow into the RCS AB! by opening HPI Valve MUV-24 BQ,ISV!. This action was taken at approximately 0343. Over the next 10 minutes, RCS pressure gradually recovered as the increased makeup flow filled the pressurizer and compressed the pressurizer steam bubble.

After RCS pressure had increased to approximately 1700 psig, MUV-24 was closed. It had been anticipated that pressurizer temperature would eventually stabilize as the event progressed, however, pressurizer temperature continued to slowly decrease. At 0354, it was decided to close the Pressurizer Spray Block Valve AB,ISV!. RCS pressure began to quickly recover. Stable RCS conditions were achieved (RCS pressure at

2155 psig, RCS temperature at 537 degrees F, and pressurizer level at 100 inches), terminating the event.

An Unusual Event (UE) was declared based on a valid ES actuation and the Emergency Plan was entered at approximately 0455. Appropriate notifications of the state and the NRC were made within 15 minutes pursuant to 10CFR50.72(a)(3). The UE declaration was untimely since the automatic ES actuation occurred at 0319 and the emergency was not declared until 0455. Once the emergency was declared, all notifications were made within required times.

This event constitutes an ES actuation and is, therefore, being reported in accordance with 10CFR50.73(a)(2)(iv).

#### CAUSE OF EVENT

The cause of this event was the failure of RCV-14. The failure was compounded by the concurrent failure of the position indication for the valve. RCV-14 is a Walworth 2.5-inch, vertical body, vertical stem, stainless steel pressure seal globe valve. The motor operator for RCV-14 is a Limitorque Actuator Type SMB-00, rated at 15 ft-lb, with a 1 horsepower 460VAC motor.

RCV-14 failed to close in both the manual and automatic modes of operation because the middle ring of braid packing had become wedged between the valve stem and both the carbon spacer ring and the lantern ring located directly below the packing. The wedging action created an extremely high running load such that when the valve was required to close, the close contacts on the torque switch opened,

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effectively removing power to the valve's motor operator. The root cause for the damage experienced by the middle braided ring of packing has not been determined. The false RCV-14 position indication can be directly attributed to a missing valve stem anti-rotation key and retaining bolt. The function of the anti-rotation key was to prevent stem rotation during valve actuation. Once the stem was free to rotate during valve actuation, the initial timing established during Motor-Operated Valve (MOV) testing between the stem's position and the geared limit switch was lost. Each successive operation of the valve served to increase the error in position indication. Inspection of RCV-14 after disassembly showed the valve stem to be within 1/32 inch from the back seat (near fully open) despite the fact that the Main Control Board "closed" indicating light was illuminated.

The administrative guidance for initiating a manual bypass of ES was inadequate, thus resulting in the inappropriate bypassing of HPI prior to automatic initiation.

## EVENT ANALYSIS

All emergency systems actuated appropriately and functioned as designed: RPS actuated due to a low RCS pressure signal of 1800 psig and all full length rods inserted; ES actuated at 1500 psig RCS pressure, initiating full HPI on both ES trains; and the ES block loading sequence proceeded as appropriate with no abnormalities. The HPI actuation also initiated EFW flow via EFIC actuation. With MFW available and adequate subcooling margin maintained throughout the event, EFW was not needed and was secured.

Although this event is not specifically addressed or analyzed in the Final Safety Analysis Report (FSAR), the relevant analyses (Chapter 6 - "Engineered Safeguards" and Chapter 14 - "Safety Analysis") indicate that as long as adequate Subcooling Margin (SCM) is maintained during an RCS depressurization event, the integrity of the core is not compromised from a lack of adequate core cooling. Since adequate SCM was maintained throughout this event, there was never any threat of inadequate core cooling.

No steam was released to the environment through the Main Steam Safety Valves or Atmospheric Dump Valves due to the low core power level at the onset of the event and the associated low decay heat load. There was never any threat to the general public or site personnel during this event.

## CORRECTIVE ACTION

The plant was placed in MODE 5 (COLD SHUTDOWN) and RCV-14 was repaired and tested satisfactorily. A comprehensive failure analysis of RCV-14 was performed, addressing all mechanical and electrical aspects of the valve failure. As a result of the failure analysis, the appropriate maintenance procedure has been revised to ensure proper installation of the valve stem anti-rotation key. Additionally, all MOVs are being reviewed for anti-rotation device applicability. This includes an

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in depth review of testing and/or maintenance history files for indications of anti-rotation devices not being installed. Other applicable Maintenance Procedures will be revised as necessary to address the installation of anti-rotation devices as required by the specific

valve design.

Training is being developed to provide direction regarding identifying and distinguishing between RCS overcooling and depressurization events, the steps to be taken to stabilize the plant in each instance, and the appropriate bypassing of ES. This training will be presented in the next cycle of Licensed Operator Requalification Training. Administrative guidance has been developed to provide direction for the appropriate bypassing of ES actuation signals.

#### PREVIOUS SIMILAR EVENTS

There has been no previous instance where a malfunction of RCV-14 resulted in automatic actuation of either the RPS or ES system. However, there have been three similar failures of RCV-14.

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CORPORATION  
Crystal River Unit 3  
Docket No. 50-302

January 7, 1992  
3F0191-08

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D. C. 20555

Subject: Licensee Event Report (LER) 91-018

Dear Sir:

Enclosed is Licensee Event Report (LER) 91-018 which is submitted in accordance with 10 CFR 50.73.

Sincerely,

G. L. Boldt  
Vice President  
Nuclear Production

WLR:mag

Enclosure

xc: Regional Administrator, Region II  
Project Manager, NRR  
Senior Resident Inspector

A Florida Progress Company

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